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Eirik Lund Sagen and Marina Tsygankova

Russian Natural Gas Exports to Europe

Effects of Russian gas market reforms and the rising market power of Gazprom

Abstract:
Gazprom, the dominant gas company in Russia, is widely believed to be the key supplier of gas to Europe in the foreseeable future. However, there are numerous uncertainties and challenges within the Russian and European gas industry that may alter the allocation of Gazprom´s gas sales between domestic and export markets. In this paper we use both theoretical and numerical models to study potential effects on Russian gas exports from changes in Russian domestic gas prices and the production capacities in 2015. We also investigate whether the liberalization of the European gas markets may provide incentives for Gazprom to induce monopoly power in its export markets. Our main findings suggest that both increased domestic gas prices and sufficient production capacities are vital to maintain Gazprom´s market share in Europe over the next decade. At low domestic prices, Gazprom may even have difficulties to carry out its long-term export commitments. However, if export possibilities are ample due to both lower domestic demand at higher prices and high overall production capacities, a large share of spot trades in Europe may encourage Gazprom to exercise market power in its export markets.

Keywords: Russia, Natural gas, production capacity, export, Western Europe, price, numerical model

JEL classification: F17, D42, Q31, Q38

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Address: Eirik Lund Sagen, Statistics Norway, Research Department.
E-mail: eirik.lund.sagen @ssb.no

Marina Tsygankova, Statistics Norway, Research Department.
E-mail: marina.tsygankova @ssb.no

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Telephone: +47 62 88 55 00
Telefax: +47 62 88 55 95
E-mail: Salg-abonnement@ssb.no

1. Introduction

The European dependence on Russian natural gas has been and continues to be a critical issue. As a consequence both political and economic aspects of gas related issues between the two regions have been thoroughly discussed in the literature; see e.g. Quast and Locatelli (1997), Oostvoorn et.al (1999), Finon and Locatelli (2002), Tarr and Thomson (2004) and Stern (1995 and 2005). In relation to the deregulation of energy markets, the European Union has extensively focused on security of supply issues, see EU (2000), and perhaps above all on the potential of rising Russian market shares in the European gas market. The Russian authorities and Gazprom plan to boost export levels of gas to Europe in the years to come.

A high market share of Russian gas should not be any threat to Europe as long as deliveries are stable and predictable. However, in addition to adapting to the EU gas directive, there are several other challenges and uncertainties within the Russian natural gas industry that have to be dealt with when predictions of future Russian gas exports are made. In West-Siberia, the main producing region, there are undefined depletion rates for several giant operating gas fields due to uncertain and unique physical characteristics. Furthermore, there is lack of financial ability to compensate for the production decline and to upgrade the aging transportation network. Finally, there are major uncertainties in connection with the speed and effect of the domestic Russian gas market reforms. The latter is mainly related to the outcome of the proposed increase in the heavily subsidized domestic gas price levels that for decades have distorted Russian inter-fuel competition in favour of gas.

For Europe, the main issue may be how Gazprom, the Russian de facto domestic monopolist and sole exporter of Russian gas, will respond to the forthcoming reforms in both the Russian and the European natural gas market. Domestic gas price increases may lead to shrinking demand, thereby creating opportunities for larger Russian export volumes. However, as the importance of spot markets and gas-to-gas competition grows in European markets, Gazprom, by virtue of its combined geopolitical position and its potential export capacity, may be the single gas supplier that convincingly could induce market power in order to influence European gas prices in the future. However, the degree of the short-term variability of gas exports to Europe will largely depend on the relative share of gas volumes sold in short-term and spot markets. Thus, given a set of capacities and contract constraints, the strategy and the allocation of Gazprom gas sales between the domestic and export markets may be vital for the level and stability of future Russian gas exports to Europe.

In this study we address the following questions:

1. How will Gazprom´s export performance towards Europe be affected by Russian domestic price increases towards 2015?
2. To what extent will the production capacities of Gazprom and other Russian natural gas producers affect exports and the allocation of sales between domestic and export markets under given domestic prices?
3. How may radical changes in the Gazprom export volumes tied to long-term contracts affect the allocation of total sales between domestic and European export markets?

We use a numerical optimisation model to study explicitly the effects on Gazprom´s optimal allocation of gas sales for a range of Russian domestic gas price levels in 2015. A central assumption in this study is that Gazprom, being a state controlled company, has an obligation to serve the domestic market at any price if necessary. That is, we assume that the current status of the Russian gas market structure will prevail for at least the next ten years. Furthermore, we assume that Gazprom continues to have both sole export rights to Europe and de facto control of third party access to transmission pipelines connecting producing regions to the domestic markets. Hence, we assume that the current relations and market structure in the Russian gas industry, as described above, are sustained over the next decade.

Even though the structure and the potential of the Russian gas sector and its coherent importance to Europe have attained great interest in both academic literature and in the political environment, there have been few, if any, previous studies that aim to model the effect from changes in Russian domestic gas prices and production capacities on future Russian natural gas exports. Thus, most studies have used a descriptive approach to the political and economic issues concerning the Russian natural gas industry, e.g. Oostvoorn et.al (1999), Finon and Locatelli (2002) and Locatelli (2003) and Stern (2005). While we in this study look at Gazprom as a monopolist, taking both transit of their export gas and other supplies to Europe as given, Hirschhausen et.al (2005) use a game theory approach to look at Russian gas exports as a result of a bargaining game between Russia and its transit countries. Other studies, e.g. Bjerkholt et.al (1990), look at the supply of gas to Europe as a Bertrand game between Russia, Algeria and Norway.

In section two of this study we highlight some important features of the markets in which Gazprom operates. In section three we introduce our model and explain some main effects theoretically, while in section four and five we present some central data input, the numerical assumptions and the scenarios

used in this study, respectively. In section six we present our simulation results and section seven concludes.

2. The structure of Gazprom´s selling markets

2.1 The domestic market: supply, demand and price

Russia has the world largest natural gas reserves, production and exports, and is the second largest consumer of natural gas after the USA, see BP (2005). Yet, or maybe as a consequence, the Russian gas industry is one of the few domestic industries that have escaped strong structural changes after Russia started its reforms towards a market economy. Hence, today the vertically integrated company Gazprom practically controls the entire gas system as it was constructed during the Soviet era, that is, most of the production and processing units, a direct ownership of all high-pressure transmission pipelines and sole rights to all gas exports to European markets.

Gazprom is formally privatized as a joint stock company, but the Russian state is the dominant shareholder and is involved in its decisions on a strategic, political as well as economic basis. Although structural reforms regarding unbundling of Gazprom have been widely discussed, see e.g. Stern (2005) and Ahrend and Tompson (2005), there have been no real changes in the activities or the structure of the company. The recent purchase of the Russian oil company Sibneft and buybacks of gas sales contracts and production rights from independent companies, as well as negotiations with regarding Turkmeni gas, have rather strengthened both Gazprom and the Russian state's position in both the Russian and the CIS gas markets. Our conjecture is that Gazprom will keep its dominant role in production and transportation of natural gas within Russia and to the CIS and Europe in the foreseeable future, and the present study is based on this view.

Besides Gazprom there is a small competitive fringe of gas suppliers represented by oil- and independent gas companies. Lead by the gas company Novatec, non-Gazprom producers supplied about 14% of the total 633 bcm[1] of gas production in Russia in 2004. The fact that independent gas producers hold roughly 30% of total Russian gas reserves tells that the independents have the potential to play an increasing role in the Russian natural gas industry in the near future. The structural development of the Russian gas industry, including the relations between Gazprom, the independent

[1] Billion cubic meters

producers and the Russian government has been discussed in a number of articles; see e.g. Stern (1995, 2005) and Locatelli (2003).

The main non-market feature of the Russian economy inherited from the Soviet era is the low regulated gas prices, with price levels historically below long-run marginal costs. Thus, domestic gas prices in Russia are currently around six times less than the high market prices received for Russian gas exports to Europe, adjusted for transport and transit costs. Formally, the price to independent gas producers is not regulated; hence they are free to charge their own price. However, as Gazprom serves the major part of the domestic market at low regulated prices, and as Gazprom is de facto in control of all gas transportation within Russia, the price at which independent producers sell their gas is close to the regulated one. As Gazprom is under tight governmental control, the company is practically enforced to secure that the domestic demand is covered at any price level. In this paper we assume that this situation will prevail, at least through 2015.

For Gazprom, the consequence of the domestic commitments has been that export profits have covered losses at the domestic market. Consequently, Gazprom has long argued for domestic price increases to improve the economics of domestic sales and, maybe more importantly, to reallocate volumes from the domestic market to export markets, early described in Stern (1995) as "the Russian gas bubble". Not surprisingly, the low price levels coupled with widespread allowances of non-payments and barters have kept the domestic demand for gas very high, and the share of gas in indigenous energy consumption in Russia is above 50%. Hence, there might indeed be great potentials for a more efficient domestic market and reallocation of gas between markets. However, fear of inflation and social instability are important arguments against a quick gas price increase in Russia. The compromise has been an official strategy of gradually increasing gas prices that hopefully would allow the Russian economy to avoid negative shocks. Nevertheless, considering the political and economic instability of the Russian economy and the historical suddenness and inconsistence of Russian economic reforms, there are still substantial uncertainties related to how gas prices might evolve.

2.2 The export markets; Europe and the CIS

Russia and Gazprom is the largest exporter of natural gas to Europe, and in 2003 Gazprom covered 24% of the EU25 gas demand and represented 45% of the EU25 total imports from external sources (including Norway). Despite the additional costs such as export duties and transit payments to Ukraine and Belarus, the European gas market is clearly the most profitable market for Gazprom.

The prices that European consumers pay for Russian gas are mostly tied to the price on other energy carriers such as oil products, and both price and volume are generally determined in relatively inflexible bilateral export contracts. Hence, for Gazprom, the contracts provide predictable sales in a medium and short run perspective. However, although Russian gas supplies roughly a quarter of the European gas market, Gazprom can hardly execute any market power without violating several of its delivery commitments. Although the EU has relaxed their stand against long-term take-or-pay contracts (EU, 2003), it is believed that the ongoing liberalization of the internal European gas market will gradually reduce the role of the long-term contracts in favour of more flexible short-term contracts and spot trade

The main CIS consumers of Russian gas are Ukraine and Belarus, and together they use about 85% of the Russian gas exports to the former Soviet republics. Close political and commercial contacts between Russia and the other former Soviet republics are vital elements when gas export contracts are made. The Russian dependence on gas transit through Ukraine and Belarus to reach western markets gives these countries further bargaining power in the price negotiations with Gazprom. Hence, prices for Russian gas in CIS markets are generally somewhat higher than inside Russia, but still considerably lower than prices paid in Europe. CIS prices are the result of short-term bilateral agreements between the countries, and are based on political as well as cost considerations.

The production potential in the CIS, particularly in Turkmenistan, is quite large. Hence, by controlling the transportation of CIS gas, Russia can use e.g. Turkmen gas to carry out its delivery commitments to Ukraine or Belarus or to its domestic users. However, in 2004 the CIS countries produced 155 billion cubic meters (bcm) of gas, while the same countries consumed 180 bcm (BP Statistical Review 2005), which means that Russia was a net supplier to the region. Especially Turkmen gas production is expected to grow substantially in the near future, reflected by the highly disputed purchase agreements between Gazprom and Turkmenistan, see Oil and Gas Journal (2005). For simplicity we will assume in the model that supply equals demand in the CIS region, and supplies to the CIS is therefore left out of Gazprom´s profit maximization problem. This is not a huge problem, as an unbalanced CIS market would have comparable implications for Gazprom as changes in the highly uncertain production level from the independent producers.

3. GAZALMOD model

The model GAZALMOD (GAZprom ALlocation MODel) is a simple static numerical optimisation model, which looks at one given year, in this paper 2015, and allows quantitative analysis of the allocation of Russian gas production volumes between domestic and export markets. The main objective of the model is, given a set of capacity constraints, to investigate to what extent different patterns of domestic gas price reforms in Russia will influence future export volumes of Russian gas to Europe. Hence, we also need to model the Russian domestic gas market response to different price levels, as well as the response from other gas suppliers to the domestic market.

Russia supplies natural gas to practically all net-importing countries in Europe. Thus, the model includes all European countries, not only current EU countries, excluding CIS. Since Russia is the main supplier of natural gas to Turkey and future exports are mainly tied to long-term contracts through the Blue Stream pipeline crossing the Black Sea, we keep Russian supply to Turkey constant and exogenously fixed in the model at 16 bcm.

The main player in GAZALMOD is the Russian state controlled gas company Gazprom, which in the model behaves as a profit maximizer in both the domestic and export markets. However, in the domestic market Gazprom has obligations to meet the demand at any price determined by the government or allow alternative sources of supply to fill the gap if necessary. Gazprom allocates its production of natural gas between the Russian domestic market at an exogenously regulated price, and the European export market, mostly determined by long-term contracts.

The natural gas sold at long-term contracts links sellers and buyers into a bilateral monopoly for a long period of time during which both parties have strictly defined obligations to trade a fixed volume of gas at a price formula defined in advance, mostly linked to oil product prices. In the model, the long-term contract prices are fixed. Thus, in the model, part of Gazprom's exports in 2015 is tied to long-term contracts that cannot be changed. The remaining part of the export is sold at the short-term market at prices based on gas-to-gas competition.

With a market share of 28% in Europe in 2004, Gazprom is by far the single largest producing company at the European gas market including UK and Eastern Europe. Next to Gazprom are the Algerian gas monopolist Sonatrach and the Norwegian company Statoil with roughly 10% market share each, see BP Statistical Review (2005) and Statoil Annual Report (2004). Although both Sonatrach and Statoil plan to increase their exports towards 2015, this uneven split of the market

supports the assumption that Gazprom is the only player with any real market power in an integrated European gas market. Hence, we assume that Gazprom can influence future gas prices in European spot markets by altering its exports, while both Norway and Algeria will always produce at their capacity limit if it is profitable. In GAZALMOD, the competition on the spot market is simplified by the assumption that other gas suppliers than Gazprom to the European market act as a competitive fringe. Hence, we model a short contract market where Gazprom faces residual demand and can execute some market power. In addition to the traditional non-Russian gas exporters to Europe, Norway, the Netherlands and Algeria, we also include indigenous supplies and LNG supplies from North Africa and the Middle East.

Within Russia, the desired supply from independent Russian gas producers is a function of their production capacity and the domestic regulated price, but the actual production is principally constrained by the permission of Gazprom to access the national gas transportation system. Even if domestic prices are low, Russian oil companies may still find it profitable to sell associated gas from their oil fields to the domestic gas market. All natural gas production capacities are exogenous in the model, that is, different production capacities of Gazprom and independent companies may create potential scenarios for various model simulations. The scenarios and their foundations will be elaborated in section five.

Gazprom maximizes its overall profit, that is, the sum of incomes from the domestic and export markets subtracted costs. In the domestic market, Gazprom supplies Q_D at a regulated price $P_{D,}$ A given part of Gazprom's income in the export market is sold at long-term contracts. Although the long-term contract prices are primarily tied to the world oil price, we treat the contract price, P_C, as well as the contract volume, Q_C, as fixed in the model. The other part of Gazprom's export supplies, $Q_{E,}$ is sold in markets determined by gas-to-gas competition rather than oil prices. The price at which Gazprom sells Q_E is determined by a residual inverse demand function $P_E(Q_E)$, taking into account the supply of Gazprom's competitors in the European market.

The supply of non-Russian gas producers is also allocated between long-term contracts and short-term contracts or spot trade. As for Gazprom, long-term contracts are to be fulfilled in the first place and the remaining supply competes at the spot market. We do not model this allocation explicitly but assume that the costs of the last unit of gas sold in Europe at long-term contracts by non-Gazprom suppliers do not exceed the price at which Gazprom chooses to sell at short-term markets.

Gazprom's objective function in the model is formulated as follows:

$$\Pi_G = \max_{Q_D, Q_E} \{P_D Q_D + P_C Q_C + P_E(Q_E) Q_E - C_G(Q_D + Q_E + Q_C) - w(Q_E + Q_C)\}, \quad (1)$$

where $C_G(Q_D+Q_E+Q_C)$ is the cost function of the production and transportation of gas within Russia. C_G is an increasing convex function, that is, $C'_G \geq 0$ and $C''_G \geq 0$. The parameter w reflects the additional costs per unit of gas exported outside Russia including transportation and transit costs.

Gazprom's optimisation problem is formulated subject to a set of constraints:

$$Q_D + Q_E + Q_C \leq K \quad (2)$$

$$Q_D + Q_I = D(P_D) \quad (3)$$

$$Q_I \leq S_I(P_D, M) \quad (4)$$

In equation *(2)*, Gazprom's production capacity, K, sets the boundary for the total supply of the company. Equation *(3)* requires that at a given regulated domestic price, P_D, the domestic gas demand $D(P_D)$ must be covered. Supply of independent producers, Q_I, can be used to supplement Gazprom's production to cover the domestic demand. Since Gazprom controls the entire transportation system of Russian gas, it also controls the volume of independent gas allowed at the domestic market.

Equation *(4)* reflects that the volume of gas that independent producers are willing to supply at the domestic market is constrained by a supply function $S_I(P_D, M)$, which is based on the profit maximization of the independent producers, given the regulated price, P_D, and the production capacity M. Thus, we have

$$S_I(P_D, M) = \min\{M, \arg C'_I(X) = P_D\}, \quad (5)$$

where $C'_I(X)$ is the marginal production cost function of the independent producers. $C'_I(X) \geq 0$ and $C''_I(X) \geq 0$. Thus, Q_I is determined endogenously in the model constrained by *(3)* and *(4)*. Constraints *(3)* and *(4)* can be reformulated as:

$$D(P_D) - S_I(P_D, M) \leq Q_D \quad (6)$$

$$Q_D \leq D(P_D) \quad (7)$$

Constraint *(7)* ensures that Gazprom's supply to the domestic market does not exceed the demand.

Then Gazprom's allocation problem *(1)*, *(2)* and *(6), (7)* yields the following first-order conditions (FOC):

FOC: *w.r.t.* Q_D: $P_D - C'_G(Q_D+Q_E+Q_C) - \lambda + \gamma - \varphi = 0$ *(8)*

FOC: *w.r.t.* Q_E: $MR(Q_E) - C'_G(Q_D+Q_E+Q_C) - w - \lambda = 0$ *(9)*

In *(8)* export marginal revenue $MR(Q_E) = P'(Q_E)Q_E + P(Q_E)$. In the FOCs Gazprom's restrictions on the production capacity, the delivery obligation to the domestic market and the restriction of Gazprom's supply to domestic consumers created by the domestic demand, are introduced with the non-negative shadow prices (Lagrange multipliers) λ, γ and φ respectively. When a shadow price is non-zero, the respective constraint is binding. Shadow price λ represents the valuation of an additional available capacity unit; shadow price γ represents the valuation of the reduction of delivery obligations to the domestic market by one unit; shadow price φ reflects the value of an additional unit demanded domestically by Russian consumers.

If $\gamma = 0$ and $\varphi = 0$, neither Gazprom's obligation to ensure the domestic demand coverage *(6)* nor the demand constraint *(7)* are binding. Then from the FOCs we get:

$MR(Q_E) - w = P_D$ *(10)*

Equation *(10)* says that Gazprom allocates its gas production between two markets, equalizing the marginal revenues between domestic and export markets. Thus, differentiating the FOCs with respect to P_D we get:

$$\frac{\partial Q_E(P_D)}{\partial P_D} = \frac{1}{MR'(Q_E)} \leq 0 \quad (11)$$

$$\frac{\partial Q_D(P_D)}{\partial P_D} = \frac{1}{C''_G} \geq 0 \quad (12)$$

In this case, a positive λ will equally raise the cost of supply to both markets, and hence, downsize the allocation choice of Q_D and Q_E.

If γ>0 and φ=0, then constraint *(6)* in Gazprom's allocation problem is binding, and Gazprom will supply more domestically than what is optimal for the company. When $Q_D=D(P_D)-S_I(P_D,M)$, where Q_D is a decreasing function of P_D, we get:

$$\frac{\partial Q_D(P_D)}{\partial P_D} = \frac{\partial D(P_D)}{\partial P_D} - \frac{\partial S(P_D, M)}{\partial P_D} \leq 0 \qquad (13)$$

In this case, in order to reduce the costs at the domestic market and to minimize domestic deliveries, Gazprom will allow as much gas as possible from the independent producers to the domestic market, hence; $Q_I = S_I(P_D,M)$ and $\frac{\partial Q_I}{\partial P_D} \geq 0$. Consequently, Gazprom's domestic supply is residual after the optimal supply of the independent producers.

If γ=0 and φ >0, then constraint *(7)* in the Gazprom's allocation problem is binding, otherwise Gazprom would supply to the domestic market more than what is demanded. Thus, Gazprom alone will cover the domestic demand; $Q_D=D(P_D)$ and $Q_I=0$, $\frac{\partial Q_D}{\partial P_D} \geq 0$. This case, however, requires a very high domestic price, P_D. This is rather unrealistic, especially within the current market framework where Gazprom operates, and will not be discussed further in the numerical analysis.

Finally, for both γ>0 , φ=0 and γ=0 , φ >0 , Q_E is determined only by (9), while Q_D is constant under the given domestic price, P_D. Differentiating (9) with respect to P_D we get:

$$\frac{\partial Q_E}{\partial P_D} = \frac{C'_G \frac{\partial Q_D}{\partial P_D}}{MR'(P_D) - C'_G} \geq 0 \qquad (14)$$

When $\lambda \geq 0$ in *(9)*, that is the production capacity constraint *(2)* is binding, and export supplies at spot market conditions is residual after domestic and long-term export supplies;

$$Q_E = K - Q_D - Q_C \qquad (15)$$

Under given P_D we define $Q^*_D(P_D)$ and $Q^*_E(P_D)$ as an optimal solution to Gazprom's allocation problem where *(6)* and *(7)* are non-binding. Then, we define two threshold gas prices P^{T1}_D and P^{T2}_D from the respective equalities $Q^*_D(P^{T1}_D) = D(P^{T1}_D) - S_I(P^{T1}_D, M)$ and $Q^*_D(P^{T2}_D) = D(P^{T2}_D)$. P^{T1}_D

express the lowest price level where the marginal profits from domestic sales exceed marginal profits from exports and $P^{T2}{}_D$ express the lowest price level where Gazprom serves the entire domestic market and all additional sales go to the export markets. Hence, $P^{T1}{}_D < P^{T2}{}_D$, and the prices $P^{T1}{}_D$ and $P^{T2}{}_D$ are both turning points of Gazprom's allocation of gas sales at increasing domestic prices, as described analytically below.

For any price, $P_D \leq P^{T1}{}_D$, then $Q^*{}_D(P_D) \geq D(P_D) - S_I(P_D,M)$ and $\gamma>0$, $\varphi=0$.
For any price, $P^{T1}{}_D \leq P_D \leq P^{T2}{}_D$, then $D(P_D) - S_I(P_D,M) \leq Q^*{}_D(P_D) \leq D(P_D)$ and $\gamma=0$, $\varphi=0$.
For any price, $P_D \geq P^{T2}{}_D$, then $D(P_D) \leq Q^*{}_D(P_D)$ and $\gamma=0$, $\varphi>0$.

4. Data and calibrations

4.1. Costs

We base the estimates of Gazprom's cost function in the model on the estimates made by OME (2004), where the Russian supply costs for delivery to the EU29 border from different production regions are estimated for the period 2010-2020. The gas delivery costs depend on the remoteness of production from the market as well as on the extraction conditions of the fields for each production alternative.

We divide Gazprom's supply costs in two separate parts, costs of production and average transportation costs within Russia respectively. In order to establish an approximate marginal cost function we apply the general functional form used by Golombek et.al (1995):

$$C'(q)=a+b*q+d*ln(1-q/K+1), \qquad (16)$$

where q is total supply ($q= Q_D+Q_C+Q_E$), K is the production capacity, and a, b and c are parameters. Calibration of the parameters is based on actual production and transportation costs data and provides the following numerical marginal cost function:

$$C'(q)=27.08+0.03*q-1.36*ln(1-q/K+1) \qquad (17)$$

Based on export duties, transit costs, and a longer transportation route of exported gas compared with domestic supplies, we include a parameter w in Gazprom`s export cost function. Data from Landes et.al (2004), Gazprom Financial Report 2004 and IEA (1993), suggest the value of w to be \$45/1000m^3.

We apply the same functional form to the marginal supply costs of independent producers as we do for Gazprom. In order to reduce the dependence on Gazprom related to gas transport, independent producers often choose their consumer markets to be relatively close to production area, see Stern (2005). This makes the average gas transportation costs of the independent producers lower compared with Gazprom. Based on cost information from the financial reports of various Russian oil companies (Yukos, TNK-BP and Lukoil) and other informations on costs and future gas projects of independent producers, we calibrate the numerical cost function for independent producers to be;

$$C'_N(q)=12.05+0.19*q-8.1*ln(1-q/K+1) \qquad (18)$$

4.2 Demand and supply elasticities

For the calibrations of natural gas demand in Europe and Russia we use 2003 data for gas prices, consumption levels and GDP levels, see BP (2005), Rosstat (2005) and World Bank (2004) and projections for GDP in Europe and in Russia by 2015, see EIA (2004). We assume that in the capital-intensive gas industry, the 10 years time span that we are looking at is a relatively short period for gas consumers and producers to adjust their behaviour following price and income changes. Therefore, mid-term elasticities that are between short-run and long run elasticities are used for demand and supply functions calibrations.

However, there is in general little consensus in the literature about the price- and income elasticities in energy markets, and estimated elasticities for Russia are almost non-existing. The elasticities that have been estimated vary and are primarily obtained for member countries of the OECD. In the survey by Al-Sahlawi (1989) on price and income elasticities of natural gas demand, short-run price elasticities range from -0.07 to -0.63 and long-run price elasticities range from -0.56 to - 4.6. Due to the lack of decisive evidence we have chosen a value for the price elasticity of natural gas demand in Europe to be -0.5, which is on the edge of short-run and long-run demand price elasticity estimates.

The only known estimates of elasticities for Russia are found in an econometric study made by Solodnikova (2004). She finds no significant link between natural gas consumption in Russia and the price of gas. The result can be partly explained by low natural gas tariffs relative to other energy carriers. As natural gas stays as the cheapest energy source in Russia, a price change may not have a notable effect on consumer behaviour. In addition, the Russian energy infrastructure was built during the Soviet planned economy and allowed low substitution possibilities between energy alternatives, hence consumers still often have to rely on one-energy carriers. Nevertheless, some studies use a price

elasticity around -0.5 for natural gas demand in Russia, see e.g. Holtsmark and Mæstad (2002) and Tarr and Thomson (2004). We choose something between the results of Solodnikova and the latter studies, i.e., *-0,3*, assuming that future domestic market reforms will bring on more substitution possibilities between different fossil fuels, so that the consumers response to gas price variations will be larger than zero in 2015.

We further assume the income elasticity of demand for natural gas in Russia to be *0.7*, which is between the short- and long run income elasticities estimated by Solodnikova (2004). Al-Sahlawi (1989) shows that in OECD countries, short-run and long run estimates of income elasticities of demand vary from 0.008 to 0.9 and from 0.1 to 6.4 respectively. For simplicity reasons we assume the income elasticities of demand in Europe to be the same as in Russia.

Referring to estimations of world natural gas supply elasticities by Krichene (2002), we choose the price elasticity of supply to be *0.7* when we calibrate the supply function of natural gas to Europe by non-Russian producers.

Changes in the elasticities used in the model will obviously have an impact on the numerical results. The best indicator of this may be the changing values of the threshold prices, described in section 3. However, the main qualitative findings, that is, domestic prices will have a systematic impact on the allocation of Gazprom gas sales between markets, will still exist. In the discussions we will elaborate more on the sensitivities of changing elasticity values.

5. Numerical assumptions and scenario descriptions

5.1 The production capacity of Gazprom

In 2004 Gazprom's production was 545 bcm, and that is slightly more than the target Gazprom publicly stated some years before; namely to achieve and maintain annual natural gas production levels at 530 bcm through 2010, see IEA (2002). The uncertainty concerning further gas field developments in Russia, which is related to both economic and physical constraints, has been one reason for such modest projections. Therefore, the risk of future production capacity shortage has already been indicated, see e.g. Oil&Gas Journal (2001) and Petroleum Economist (2002).

The three West Siberian giant gas fields, Medvezhye, Urengoy and Yamburg, currently accounting for roughly 63% of Gazprom’s production, have all reached their peak of production and experience a

production decline, see Stern (2005). There are major uncertainties concerning how the future decline rates at these fields will develop. The Siberian giant fields are unique and they have already experienced different patterns of production decline. Uncertain physical characteristics, related to both the overall field size and the development in field pressure, make the future decline rates of these fields highly uncertain.

The largest developed gas field in the European part of Russia is Orenburg, however, this gas field is also in its decline phase. We assume that the growing production from the Astrakhanskoye field might compensate for this decline. According to estimates by Landes et.al (2004), production from the Russian satellite fields might be doubled during the next decade under favourable economic conditions. On the other hand, various conjectures about the production from the "big three" West Siberian fields by 2015, give us an annual production range from these fields of 150 bcm-270 bcm.

The giant Shtokman field in the Barents Sea and the fields of Yamal Peninsula have both vast gas deposits. Difficult mining conditions require huge investments, hence production start-up from both these fields has been constantly postponed. As it is projected today, e.g. in Landes et.al (2004), production from Yamal might start between 2010 and 2015 at the earliest, and Shtokman gas will likely reach the European markets even later. Taking into consideration the recent Gazprom strategy to sell Shtokman gas to US using the LNG technology rather than piping it to Europe, a pipeline to Europe from the Barents Sea seems even more distant. Therefore, we believe that towards 2015, primarily smaller associated fields in the West-Siberian Nadym-Purtaz region, often called satellite fields, will compensate for the production decline of the three giants.

Due to the huge uncertainties regarding the physical field characteristics of the most central producing gas fields in Russia, we choose to run different scenarios of production capacities rather than modelling the capacities endogenously based on cost figures. We look at three plausible scenarios of Gazprom's production capacity in the model. We choose the current production capacity at 540 bcm as our medium scenario and the production capacities of 500 bcm and 580 bcm are chosen to be pessimistic and optimistic scenarios respectively.

5.2. Independent producers production capacity

Although independent producers account for only 14% (roughly 88 bcm) of current Russian production, it is assumed that they have proven reserves to increase their gas production substantially. A number of oil companies have indicated that they are willing to boost both utilization of associated

gas and production from their pure gas fields if they are guaranteed access to markets, see Landes et.al (2004) and WGI (2005). Novatek, currently the largest independent gas producer, supplied 5% of Russia's domestic gas market in 2004, and a forecasted production growth indicates that the company alone may be able to reach a production level of 50 bcm already by 2010, see WGI (2005b).

According to "Russia's Energy Strategy through 2020" (2003), the volume of "independent gas" at the domestic market can reach 120-135 bcm per year by 2015. But even though the production potential of independent producers is high and the investment shortage is not an obstacle, as long as Gazprom can control the market access, independent producers are reluctant to initiate new projects that will increase their production capacity. On the other side, even if Gazprom opens up for competition, the independent producers will still need several years to increase their capacities. In this study we consider three scenarios for independent producer's production capacity; 80 bcm, 120 bcm, and 160 bcm respectively.

5.3 Transportation capacity

In spite of the widely discussed transit friction that Gazprom faces in Ukraine, we assume that sufficient export transportation capacity to Europe will not be any problem the next decade. "Russia's Energy Strategy Through 2020" (2003) estimates the export to Europe by 2015 to be somewhat lower than 160 bcm. The already existing export pipelines through Ukraine and the Yamal-Europe corridor through Belarus can carry 168 bcm of gas to Europe annually. During the next decade the Yamal-Europe pipeline is expected to expand from the current 20 bcm capacity to the initially planned capacity of 33 bcm per year. The construction of the North European Pipeline through the Baltic Sea, as a diversification alternative for Gazprom's export routes, will give at least an extra 20 bcm of export transportation capacity annually. These projects, together with an ongoing joint project by Gazprom and the Ukrainian oil and gas company NaftoGaz Ukrainy to boost export capacities through Ukraine through increased compression, can provide Gazprom a total of 225 bcm annual export transportation capacity by 2015, see Landes et.al (2004). As the expected transport capacity seems to be well above all known export targets, we do not explicitly model any export capacity constraint, however, we report in the discussions if the modelled outcomes for Russian exports in 2015 exceed the assumed transport capacity number.

In 2004, the Russian domestic gas transmission system handled a total 687 bcm, see Landes et.al (2004). This is well above Gazprom's total production that year and includes transportation of transit

gas, mainly from Turkmenistan, and gas from independent producers. We assume excess capacity in the domestic transmission network towards 2015.

5.4 Long-term export contracts

A more competitive European gas market implies the entrance of new contract mechanisms, such as spot-markets and short-term contracts. Whereas long-term contracts remain important, their share and average contract duration will be reduced, see Neumann and von Hirschhausen (2004). Nevertheless, with today's regular contract duration of 15-20 years, a large portion of the European gas market will still be fed by long-term contracts by 2015. A large volume of long-term contracts creates heavier obligations and less flexibility for Gazprom`s exports. On the other hand, long-term contracts constitute a firm basis for investments and ensure financing for the capital-intensive infrastructure field developments.

In this study we use the relative share of natural gas traded at long-term contracts as an indicator of how quick the liberalization process will go forward. In 2004, Russian exports of natural gas to Europe reached 140 bcm, and practically all this gas was sold at long-term contracts. As our focus is on a ten-year horizon, a significant portion of the long-term contracts that Gazprom has today will not end before 2015. By 2015, it is believed that one third of the gas traded in Europe will be sold at short-term contracts or spot markets, see Fellers (2004). Hence, with the "Russia's Energy Strategy Through 2020" estimate of exports to Europe at 160 bcm, we assume 120 bcm to be a base scenario for the volume of Russian gas export sold at long-term contracts in 2015.

In order to test for a response to variations in long-term contracts, we also run the model for volumes of long-term contracts in 2015 at 80 bcm and 160 bcm, which indicate quick and slow liberalization progress scenarios respectively in the European market. Running the model with the domestic price range we assume the price and volume of long-term contracts is fixed. Hence, we assume that the contract price is equal for all long-term contracts, including new contracts in the "slow liberalization scenario. When the liberalization of the European gas market is quick, contract renegotiations will explain the reduction of long-term contract volumes to 80 bcm.

5.5 The domestic price reform

As described earlier, massive investments in the Russian natural gas industry are needed to develop new fields, to compensate for the decline of the West Siberian giants and to improve the gas infrastructure. The increase of domestic gas prices is therefore believed to be essential to provide the

necessary investments into the Russian gas industry, consequently, a gradual price increase is one of the main elements in the Russian energy strategy.

Since 2000 industrial domestic prices on natural gas have been raised by 10-20% annually in nominal terms. However, real price growth was positive only during last two years with 14% and 5% in 2004 and 2005 respectively. Under current prices and exchange rate, domestic gas price raised from 27$/thousand m^3 in 2000 to 32$/thousand m^3 in 2005. "Russia's Energy Strategy Through 2020" (2003) stipulates further gradual growth of domestic gas prices and foresees the price to be over 64$ by 2015 in current prices. An average annual increase of 8% in real and 17 % in nominal prices will be required to reach the aimed price level. However, we assume that the government will not allow an annual growth of the natural monopoly tariff that exceeds the inflation target of 8-10% by too much. Taking into account the regular downward adjustments of earlier projected domestic price increases, we adopt a modest projected price development in our model. Hence, taking into account great uncertainties concerning the future domestic price level, we run the model with a domestic price range for 2015 (in current prices) of 37-64 $/1000 m^3 for all potential scenarios, shown in table 1 below.

Table 1: Adopted scenarios

Gazprom's production capacity ("cap") (bcm)	Independent gas producers production capacity ("ind") (bcm)	Volume of long-term export contracts ("Qc") (bcm)
500	80	80
540	120	120
580	160	160

6. Model results and discussions

In the discussions below, our aim is to highlight the model results based on our main research questions. The fundamental assumption in all the scenarios is that Gazprom is in total control of both exports to European markets and pipeline access to domestic markets. Furthermore, it is essential for the results that we in all scenarios assume a political "domestic-market-comes-first" attitude when it comes to the Russian state regulation of the Gazprom gas supplies. In table 2, below, we outline the mechanisms behind the model results that are discussed later in this section. The table shows four possible phases of Gazprom and independent gas supply decisions as the domestic gas price varies from our low-end level ($37/ 1000 cm) to our high-end level ($64/1000 cm).

Table 2: Different output-phases in GAZALMOD

	I	II	III	IV
Regulated domestic price level *(P_D)*	Low end ($37/ 1000 cm)	===> $P^{Tl}{}_D$ ===>		High end ($64/1000 cm)
Gazprom Capacity *(K)* vs. Total supply *(S)*	$K = S$	$K > S$	$K > S$	$K = S$
Gazprom domestic supply decision	Min. domestic $\frac{\partial Q_D}{\partial P_D} \leq 0$	Min. domestic $\frac{\partial Q_D}{\partial P_D} \leq 0$	Optimal domestic $\frac{\partial Q_D}{\partial P_D} \geq 0$	Max. domestic $\frac{\partial Q_D}{\partial P_D} \geq 0$
Gazprom short-term export supply decision	Max. exports $\frac{\partial Q_E}{\partial P_D} \geq 0$	Optimal exports $\frac{\partial Q_E}{\partial P_D} \geq 0$	Optimal exports $\frac{\partial Q_E}{\partial P_D} \leq 0$	Optimal exports $\frac{\partial Q_E}{\partial P_D} \leq 0$
Independent supply decision	Optimal $\frac{\partial Q_I}{\partial P_D} \geq 0$	Optimal $\frac{\partial Q_I}{\partial P_D} \geq 0$	Constrained $\frac{\partial Q_I}{\partial P_D} \leq 0$	Constrained $\frac{\partial Q_I}{\partial P_D} \leq 0$

We see that for the lowest domestic prices, Gazprom generally wants to minimize the sales domestically, as indicated by phase I and II, hence a maximum of independent supplies are desirable. However, the low prices give no incentives for independent producers to supply at their capacity limit if the price is lower than their marginal costs of production. Consequently, Gazprom has to cover a relatively larger residual domestic demand at any cost due to their obligations as the supplier of last resort at the domestic market. For the low-end prices, the residual domestic demand is so high that Gazprom will use all of its leftover capacity to serve the more profitable European export market.

At slightly higher domestic price levels, the demand response is negative, creating possible additional volumes for the export markets. This continues up to a certain point where Gazprom´s supply to the European short-term market is so large that marginal revenues at the European spot market equal the marginal costs of exports, hence Gazprom´s production are no longer constrained by production capacities, as indicated by phase II. Gazprom will still allow as much independent gas as possible, as long as domestic prices are lower than marginal costs, which means that independents can supply as much as they want.

Higher domestic prices will eventually lead to a turning point for the allocation of Gazprom supplies that is when domestic market becomes profitable. This will effectively lead to a gradual shift of

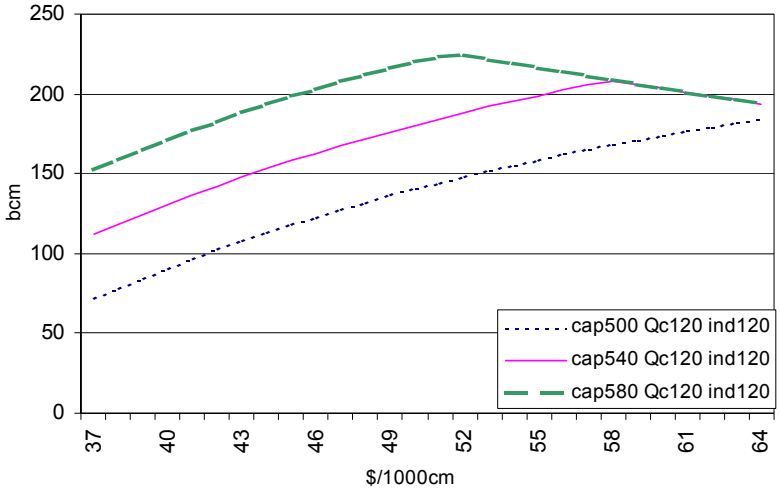
Gazprom supplies from export markets to the domestic market. Therefore, the access of independent producers is kept below their desired optimal production level, as indicated by phase III. In this phase Gazprom's overall production may be below its production capacity if overall capacities are high. In the last phase IV, domestic prices are so high that Gazprom wants to use all its residual production capacity to serve the domestic market after export profits are maximized.

Needless to say, the realization of these model phases will highly depend on the various combinations of the capacity- and contract constraints that are applied in this study. The discussions below will sum up the main findings concerning the allocation of Gazprom´s supplies when faced with the different capacity- and contract constraints.

6.1 Production capacities and export performance

In order to isolate the effects on Russian exports from changes in the domestic price and Gazprom´s production capacity we keep the level of independent production capacity and long-term contract export volumes constant at their assumed medium levels, both at 120 bcm in our model year 2015. Figure 1 shows total exports towards Europe for medium (540 bcm), high (580 bcm) and low (500 bcm) Gazprom production capacities as a function of the domestic price range applied in this study.

Figure 1: Russian gas exports to Europe at constant independent supplies



cap=Gazprom`s production capacity, Qc=long-term contract volume, ind=independent producer's production capacity

As higher domestic prices restrain domestic demand in Russia, a larger export potential is created, often described as the Russian natural gas bubble. We find that the Russian domestic natural gas demand shrinks by roughly 80 bcm in 2015 if the domestic price is increased from $37 to $64 per 1000 cm. This is a strong indication that the Russian domestic gas market reforms alone may have a substantial effect on the total amount of Russian gas sold in the European market.

As long as export markets are more profitable, Gazprom will allow maximum independent domestic supply at any domestic price. However, for the low domestic prices, independent supplies are constrained by their own cost function and capacity. Thus, in this situation Gazprom would have preferred to earn more on additional sales to export markets if other suppliers had covered more of the domestic market in the first place. As Gazprom exports above the long-term contract level will have a downward effect on European gas prices, Gazprom will face declining marginal profits to the point where marginal export costs equals marginal export revenues in the short term market, referred to as phase II in table 2. In this situation Gazprom will hold back exports even though there are both production and transport capacities available. Our results indicate that given medium independent production capacities and medium long-term contract volumes, only the optimistic Gazprom production capacity scenario will provide sufficient export volumes to induce any market power at the export market, as the domestic market will claim or attract too much of Gazprom´s total capacity.

When the domestic price increases and the European short term market price decreases, it also moves the marginal profitability of gas sales in favour of the domestic market to the point where the domestic market is profitable, referred to as phase III in table 2. This is clearly shown in figure 1 for both the medium and high Gazprom capacity alternative, as export numbers starts to fall when the domestic prices are sufficiently high.

We observe that for domestic prices in the lower range, Gazprom is actually unable to carry out its export obligations of 120 bcm, even when the company achieves its most likely production capacity of 540 bcm per year. This is obviously also severely behind its future export targets[2], and even for domestic prices at $64/1000 cm, the target may not be reached if the production capacity of Gazprom falls to more pessimistic levels.

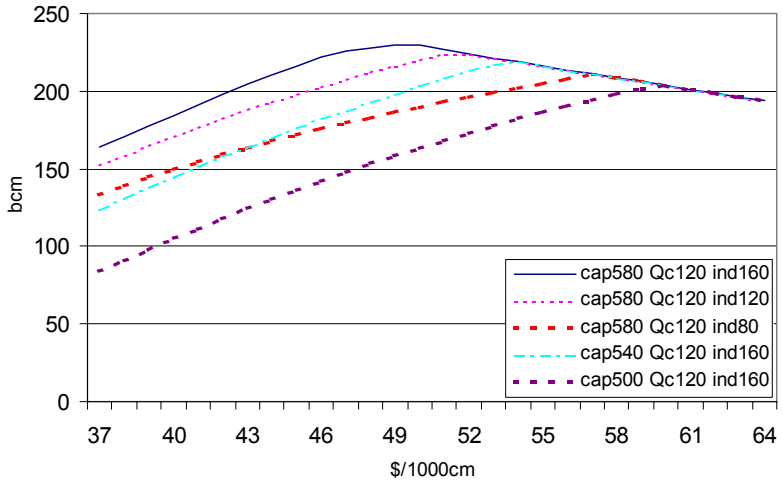
We find that only when we look at the optimistic production capacity scenario, Gazprom will meet its long-term export contract obligations at any domestic price after domestic markets are taken care of.

[2] Gazprom aims to reach an export level towards Europe of at least 190 bcm per year by 2010, see WGI (2005c)

In this scenario, the export targets are also met at sufficiently high domestic prices. However, even in the optimistic scenario, the assumed export transportation capacity limit of 225 bcm in 2015 is not met.

From the discussions above, we clearly see that both domestic price reforms and sufficient independent gas supplies seem to be essential for the Russian gas industry in the future. If Gazprom is forced to give priorities to domestic market obligations, it is straightforward that Gazprom export volumes will suffer badly from the potential lack of supplies from alternative producers, particularly if the Gazprom production capacity is too low to compensate for the decline itself. Figure 2, below, shows the importance of independent supplies for Russian exports as we compare various combinations of Gazprom and independent production capacities at the same range of domestic price levels, holding Gazprom export contract obligations constant at 120 bcm.

Figure 2: Russian gas exports to Europe at different levels of independent supplies



The importance of independent gas supplies for the Russian gas exports is most obvious when we compare two scenarios with optimistic Gazprom capacities, of which the scenarios implement an optimistic independent supply of 160 bcm and a pessimistic supply of 80 bcm respectively. If Gazprom production capacity growth and independent capacity reductions (or vice versa) outweigh each other, our results show that exports are higher for larger Gazprom capacities. This is due to the independent producer's profitability requirements that make these producers an unreliable replacement for Gazprom domestic supplies, particularly at low domestic prices. Thus, exports may be sacrificed if Gazprom capacities are low, even in the optimistic independent capacity alternative. Figure 3

explicitly shows the volumes of independent gas supplies for the same scenarios displayed in figure 2, and thus highlights Gazprom´s control over independent pipeline access.

Figure 3: Domestic supplies from independent gas producers

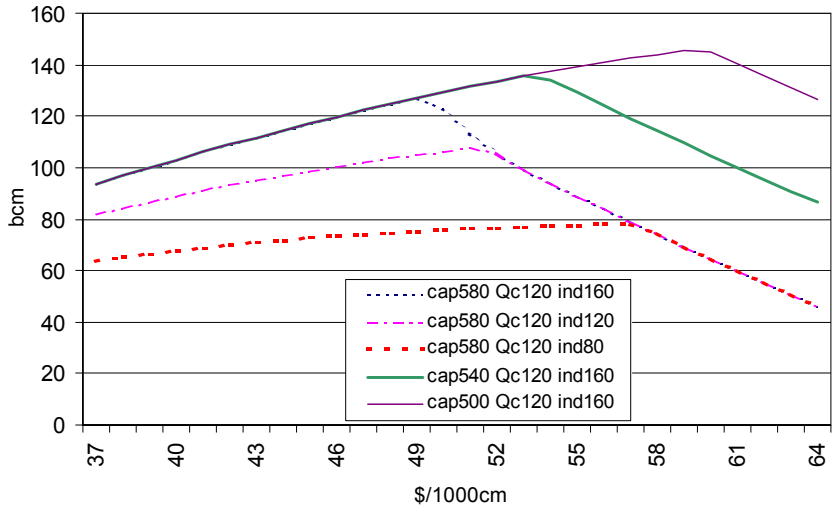


Figure 3 shows that only when the combined Gazprom and independent capacity is low, independent producers will supply gas at their optimal levels, even for the highest domestic price levels. At sufficiently high overall capacities, Gazprom will exercise its monopoly power in the domestic market to squeeze independent supplies if domestic prices are high enough to make the domestic market profitable.

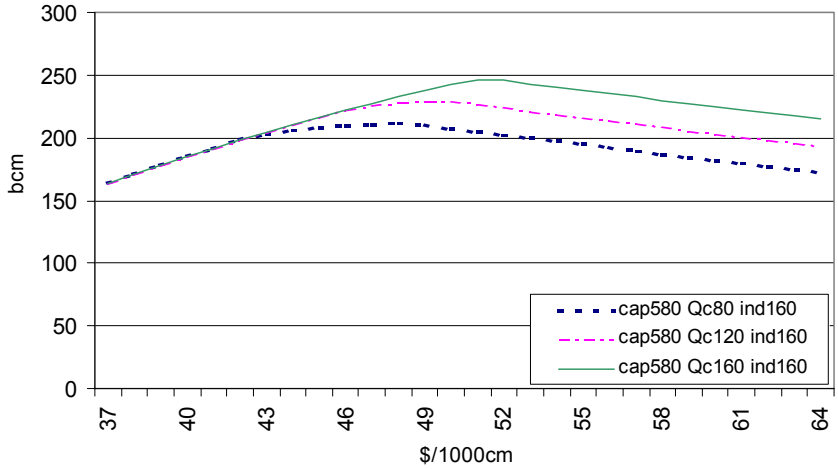
On the other hand, if Gazprom has sufficient production capacities, we find that optimistic independent supply may create greater possibilities for Gazprom to exercise market power in Europe at domestic prices below the market profitability "turning point", as we observe that Gazprom produces up to 20 bcm less than capacity in this situation.

6.2 The role of long-term contracts for the allocation of Gazprom supplies

In this section we will take a closer look at the potential effects from a changing European gas market structure on the levels of gas exports from Russia towards Europe. We use three different levels of assumed long-term volume contracts connected to Gazprom in 2015, indicating different stages in the process towards an open spot market based European gas market. Having a look at our earlier findings, it is obvious that the allocation of Gazprom supplies is more likely to shift for larger overall Russian production capacities of natural gas. That is, our findings suggest that when export markets

are more profitable, Gazprom will use available independent capacities to cover parts of the domestic market and reallocate its sales towards Europe. If the domestic market is more profitable, Gazprom will reduce its exports and reallocate its supplies towards domestic markets until sales in both markets are equally profitable at the margin. The latter Gazprom strategy, however, is only viable if export volumes are not already tied up in inflexible long-term contracts of which both price and volume are fixed. Hence, a liberalised European export market, largely determined by more flexible short-term contracts and spot sales, seems to favour Gazprom in terms of possibilities to exercise market power in the European market. As our findings suggest that larger overall production capacities will create better terms for a flexible allocation of Gazprom supplies, we want to investigate the effect from different European market structures given optimistic capacities of both Gazprom and independent producers. The results are shown in figure 4 below.

Figure 4: Russian gas exports to Europe at different long-term contract volumes



As figure 4 clearly reveals, the level of gas exports tied to long-term contracts may prove to be highly significant for Gazprom´s allocation of gas sales in the future. Our results indicate that Gazprom will reduce its exports in favour of domestic gas sales at lower domestic prices and at lower export volumes if long-term contract volumes are reduced. At the lowest Russian gas prices in our study range, $37/1000 cm, we see that the level of contract volumes plays no role for Gazprom´s export performance. However, as domestic prices increase, there is a growing difference in export performance, depending on the initial level of gas volumes tied to long-term contracts. The rationale behind this finding is that export prices are more sensitive to additional exports when the share of flexible short-term markets is large. Thus, in this situation, Gazprom has incentives to hold back

exports to prevent prices from falling too much. As Gazprom faces increasing marginal costs for higher production levels, we find for the low domestic prices that Gazprom holds back its total production to achieve optimal sales in both domestic and export markets. In this situation domestic prices are not large enough to cover the costs and increased exports will lead to lower export prices than what is optimal for Gazprom. Hence, Gazprom regulates its export volume to achieve optimal prices and revenues in its export market, and regulates independent supplies to achieve optimal revenues in the domestic market. This active use of price oriented market power in export markets and volume based market power in domestic markets are best shown by displaying the Gazprom total production level, shown in figure 5 below.

Figure 5: Total Gazprom production at different levels of long-term contract volumes

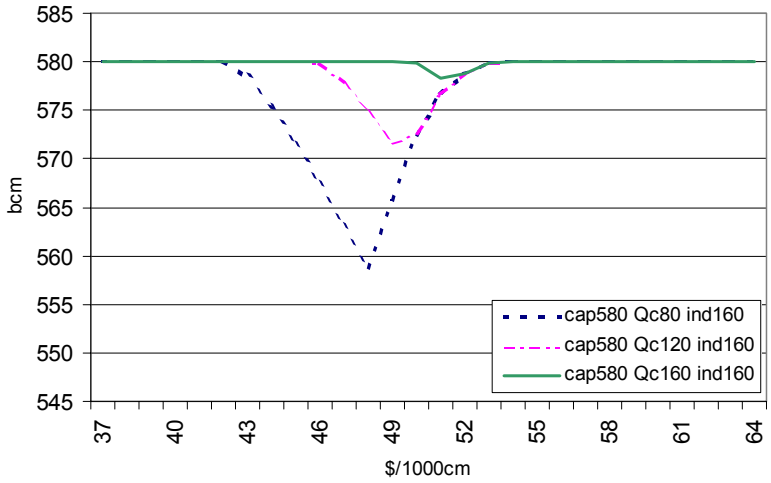


Figure 5 clearly reveals that with larger sensitivity of export prices, shown by a larger spot market, the larger are the incentives and willingness to use accessible market power to influence prices in that particular market. Hence, in a situation with long-term contract volumes of 80 bcm, Gazprom may end up with an excess production capacity of roughly 20 bcm per year. This excess capacity is, of course, a combined result of a large and price sensitive spot market and the flexibility in production created by a smaller domestic market due to the higher regulated prices. When the total production starts to increase in figure 5, it is an indication that at the production turning point, the domestic price level is large enough to cover the production costs. Hence at this point Gazprom start to replace independent supplies at the domestic market.

When contract volumes occupy most of the exports, the spot markets are too tiny to have a significant effect on the average export price level. Thus, in this scenario, given the high overall production capacities, our results show that Europe may even experience a Russian export level close to 250 bcm, see figure 4. In this case, however, transportation capacities may be a serious bottleneck.

6.3 Sensitivity of changing elasticities in GAZALMOD

A change in the elasticities applied in the model will not alter the primary qualitative results, that is, domestic prices will have a systematic impact on the allocation of Gazprom gas sales between domestic and export markets. However, it is natural to expect some changes in the absolute values of Gazprom supplies to the consumer markets. The model sensitivity to changes in elasticities will primarily relate to a shift of the threshold prices, discussed earlier in section 3, and the corresponded export level. Table 3, below, summarizes the relative change in threshold price $P^{TI}{}_{D}$ and Gazprom's export volume when each elasticity parameter in the model is increased and reduced alternately, keeping all other parameters at their base levels. We use the medium capacity scenario[3] for all sensitivities. The results show that changes in the price- and income elasticities of the Russian gas demand give by far the most vital effects on the model output.

Table 3: Effects of elasticity changes on $P^{TI}{}_{D}$ and Gazprom's export (in %)

	Demand price elasticity in Russia		Demand price elasticity in Europe		Demand income elasticity in Russia		Demand income elasticity in Europe		Supply price elasticity of non Russian producers	
Elasticity used in the model	*-0,3*		*-0,5*		*0,7*		*0,7*		*0,7*	
New Elasticity	*-0,1*	*-0,5*	*-0,3*	*-0,7*	*0,5*	*0,9*	*0,5*	*0,9*	*0,5*	*0,9*
Change in $P^{TI}{}_{D}$(%)	52	-15	-2	3	-14	19	-5	7	-2	2
Change in export (%)	-32	11	-3	1	9	-13	-5	4	-2	0,3

[3] Gazprom production capacity (cap) = 540 bcm, long-term contract volume (Qc) = 120 bcm, independent production capacity (ind) = 120 bcm

7. Conclusion

The aim of this study has been to highlight the possible outcomes for Russian gas exports to Europe at different Russian domestic gas prices in 2015. Given a plausible range of Russian domestic gas prices, we have run scenarios based on fundamental uncertainties regarding Gazprom and non-Gazprom production capacities and the speed of European market deregulations. With regard to the European security of supply issue, we believe that all these factors should be considered carefully when predicting future Russian exports to Europe.

Firstly, it seems obvious that increased domestic gas prices in Russia will create improved export possibilities due to decreased Russian gas demand. In fact, a Russian gas market price reform may be absolutely necessary if Russian export targets and even export commitments through long-term contracts are to be achieved. Still, if Gazprom continues to be the domestic gas provider of last resort, scarce production capacities of both Gazprom and independent producers will restrict export volumes due to the assumed governmental domestic market priorities. Secondly, our results indicate that if domestic prices become sufficiently high, the domestic market becomes the most profitable market at the margin. This will also lead to relatively lower Russian gas exports.

Finally, an interesting finding of this study is the potential of Russian market power in Europe created by relatively smaller shares of long-term contracts due to the liberalization of the European gas market. This means that a European gas market based on gas-to-gas competition may experience an upward pressure on gas prices due to Gazprom`s monopolistic behaviour in its export markets.

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